Technical Specification

for a

Spare Shapemeter Roll

and

Spare Parts

for our W.O. 75-11085

Project No.: 7.2120.0

Date: June 21, 2012

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1. General

1.1 Engineering Standards

The design, manufacture and testing as well as the documentation of the electrical equipment will be in accordance with:

- ISO International Standardization Organization
- IEC International Electrotechnical Commission
- DIN Deutsche Institut für Normen
- SUNDWIG AUTOMATION works and design standards
- The project language is English

1.2 Rolling Mill Technical Data

Type of rolling mill		20-high mill
Strip material		stainless steel
Strip thickness	min.	0.2 mm
	max.	6.0 mm
Strip width	min.	800 mm
	max.	1,300 mm
Strip tension	min.	20 kN
	max.	500 kN
Wrap angle on the shapemeter roll	min.	21.6°
	max.	52.6°
Rolling speed	max.	700 m/min
Acceleration/Deceleration	max.	s
Coefficient of friction strip/roll		0.07
Strip temperature	max.	180 °C

If the technical data should change, the quotation must be revised.

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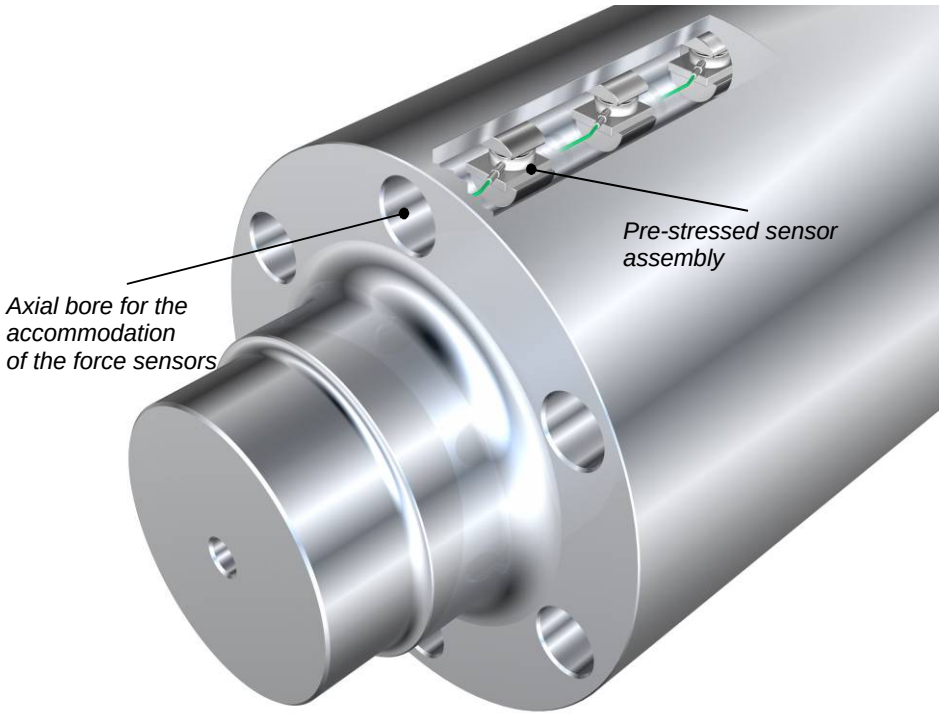
2. Scope of Supply

2.1 One (1) Spare Shapemeter Roll

One (1) Shapemeter roll for the entry or exit side, consisting of:

- the from solid steel made roll body;

  Bores running transversely to the strip width are integrated in the roll body to accommodate the force sensors. The force sensors are fastened under high pre-stressing in the bores. The deflecting forces (radial forces) having an effect from the strip via the bore arch on the force sensors are measured. The shapemeter roll has a completely closed roll surface (gap-free and homogeneous).



- the complete bearings with grease lubrication mounted in solid bearing housings. The bearing housings are sealed with grease-grooves.
- shapemeter roll grinding adapters (for the use on roll grinder);
- protective cover for the data transmission unit;

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Technical Data of the Shapemeter Roll:

Diameter	450 mm
Grinding range	6 mm in diameter
Design of roll surface	tungsten carbide
Roll surface hardness	(Vickers) HV1350
Coating thickness	150 microns
Roll surface hardness before coated	HRC 56 + 2
Measurement zone width (see note) *)	26/52/26 mm *) edge/center/edge
Number of measurement zones	12/14/12 edge/center/edge
Total number of measurement zones	38
Measuring width	1,404 mm
Roll weight	2,340 kg
Operating temperature	+ 180 °C max
Ambient temperature of the roll electronics	+ 60 °C max
Colour of painted components	RAL 6011 (green)

The spare shapemeter roll is without problems with the existing shapemeter rolls (W.O.75-11085) in the 20-High Reversing Mills exchangeable.

***) Influence of the Measuring Zone Width on the Shape Measurement**

A sufficiently precise resolution of the actual strip shape (length distribution) will only be reached if at least in the area of the strip edges narrow measuring zones of e.g. 25 (26) mm width will be used. This is especially applicable if buckles on the strip edge have only a width of 30 to 40 mm resp. high gradients of the strip shape are available. These buckles resp. high gradients can not be detected with a measuring element distance of 50 (52) mm.

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Shapemeter Roll Electronics

a) Piezoelectric force sensors (quartz crystals) integrated in the roll body:

- minimum resolution measuring force of force transducer (piezo-quartz): abt 0.02 N;
- lowest possible measuring force per measuring zone (integrated piezo quartz): abt 0.2 N;
- highest possible measuring force per force transducer: abt 60,000 N
- highest possible overload per force transducer: abt 72,000 N

The sensors are wired to a terminal board mounted in the roll neck and connected from there to the transmitter system. A ceramic adapter serves the thermal separation between the roller neck and the transmitter system.

b) Contactless data transmitter with charge amplifier

- Contactless rotary transmitter: 24 channels
- Number of amplifier channels: 24

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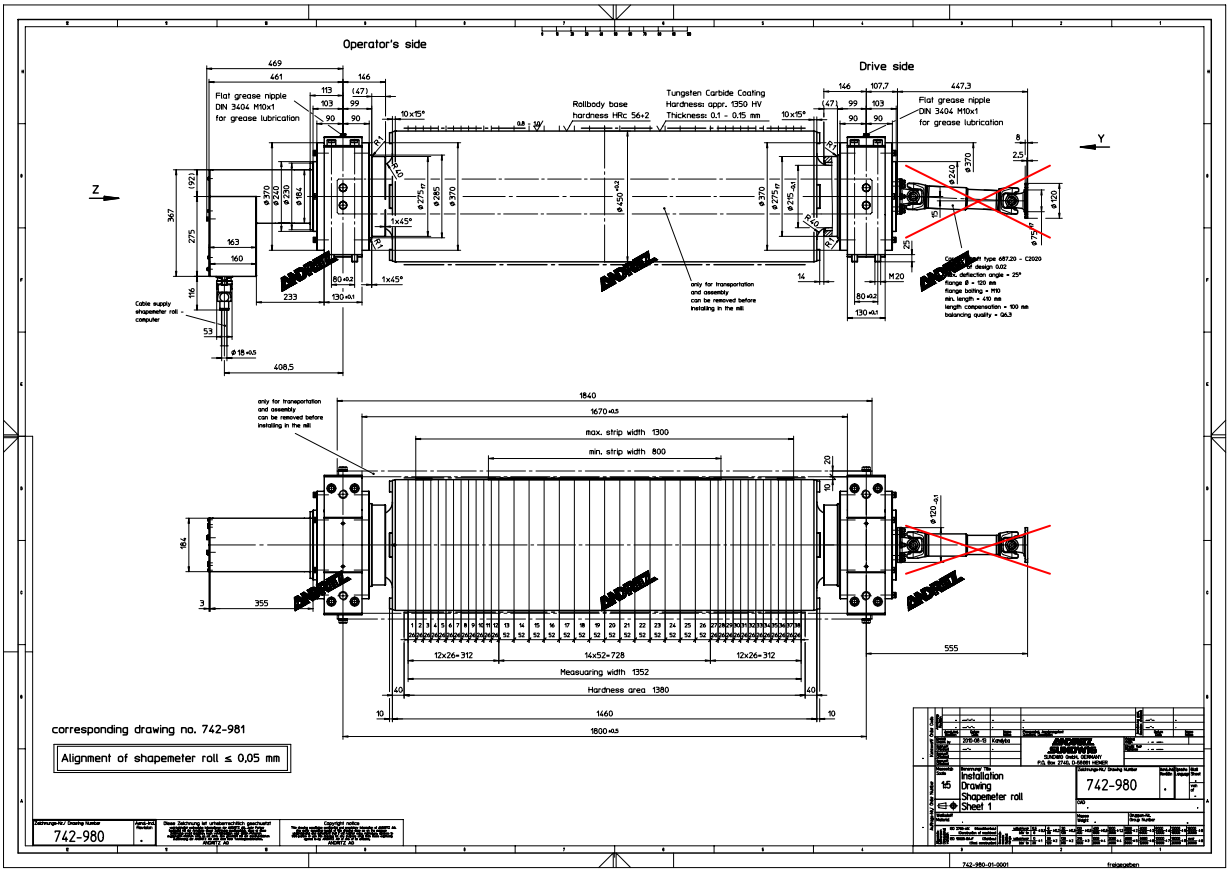
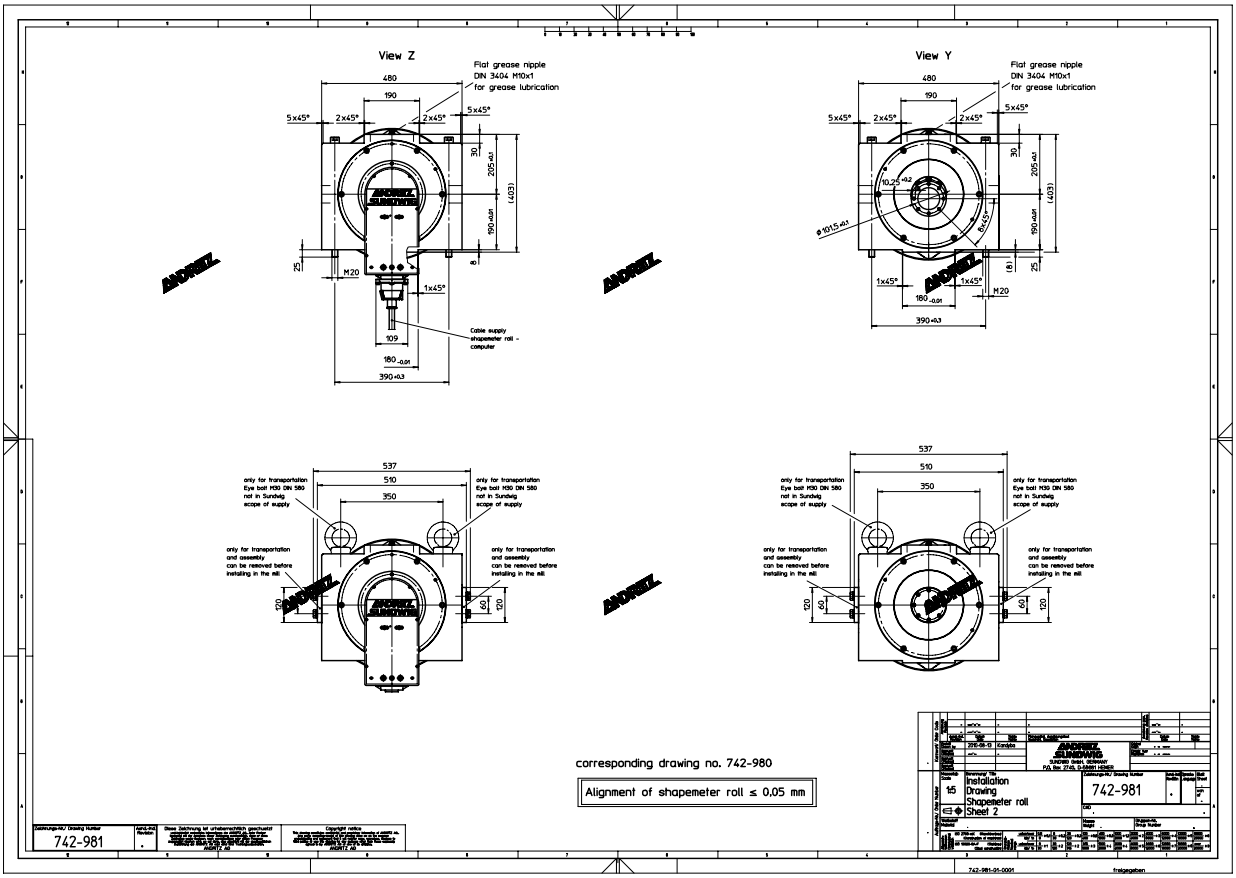
Outline Dimensions of the shapemeter roll:


Operator's side
Drive side
Flat grease nipple DIN 3404 M10x1 for grease lubrication
Rollbody base hardness HRc 56+2
Tungsten Carbide Coating Hardness: appr. 1350 HV Thickness: 0.1 - 0.15 mm
Flat grease nipple DIN 3404 M10x1 for grease lubrication
Cable supply shapemeter roll - computer
only for transportation and assembly can be removed before installing in the mill
max. strip width 1300
min. strip width 800
Measuaring width 1352
Hardness area 1380
corresponding drawing no. 742-981
Alignment of shapemeter roll ≤ 0,05 mm
Installation Drawing Shapemeter roll Sheet 1
742-980


View Z
View Y
Flat grease nipple DIN 3404 M10x1 for grease lubrication
Cable supply shapemeter roll - computer
only for transportation Eye bolt M30 DIN 580 not in Sundwig scope of supply
only for transportation and assembly can be removed before installing in the mill
corresponding drawing no. 742-980
Alignment of shapemeter roll ≤ 0,05 mm
Installation Drawing Shapemeter roll Sheet 2
742-981

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2.2 Documentation

A SUNDWIG standard documentation (3 copies) in English language will be supplied. The documentation includes all relevant information for installation and operation of the system.

Designation	Date	Number / Form
Final documentation: ▪ Operating and maintenance instruction; ▪ Assembly drawings; ▪ Grinding drawings; ▪ Sensor distribution plan; ▪ Spare parts lists;	With delivery	3 x paper and 1 x CD with: ▪ Mechanical CAD-drawings / DXF; ▪ Documents / PDF.
PO = Coming into force of the order / W = Weeks		

Note:

A „Freeware“ version of the Adobe Acrobat Reader will be supplied along for the reading of the PDF-files.

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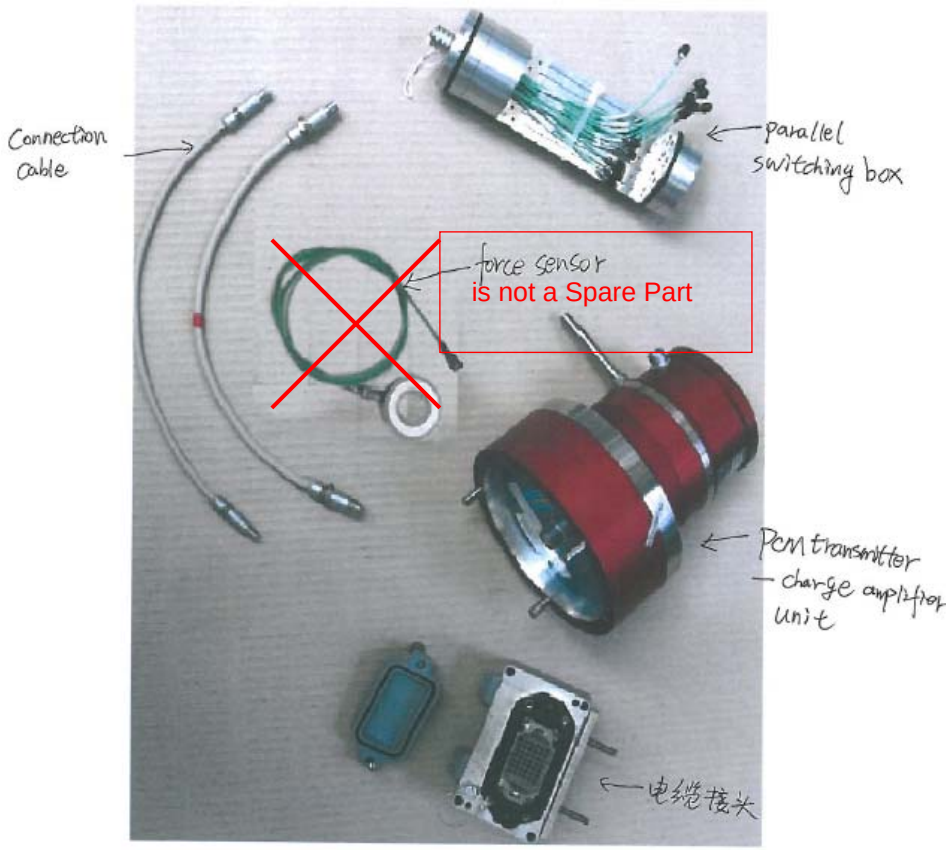
2.3 Spare Parts

We offer you the wished following spare parts.

PRICE LIST SPARE PARTS			
Item	**Qty**	**Description**	**Priority / Class**
		Spare Parts Shapemeter Roll:	
1	2	Roller bearing (Type: 22236 CC/N33 C3)	1
2	1	Parallel Switching Box (Type: Z20779C)	1
3	1	Rotary transmitter (Type: GL24T) with charge amplifier 24 Ch (Type: Z20739)	2
4	1	Connection Cable (Type: WN4030-X32)	1
5	1	Connection Cable (Type: WN4030-X37)	1
6	1	Cardan shaft (Type 687.20 C2020)	2
7	1	Distribution Box (Type: WN4080-S-42)	2

Class 1: Recommended spare parts for start up and two (2) years of operation
Class 2: Long term spare parts



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3. Materials and Services not in SUNDWIG's Scope of Supply

Our scope of supply includes all components and services which are explicitly described in this proposal as our scope of supply. Scopes of supply going beyond will be made available to us free of charge or will be offered by us separately on request, consisting of e.g.:

- workshop drawings / manufacturing drawings;
- shapemeter roll removal and mounting device;
- supply air and exhaust air channels as well as preparation of cooling air for cooling of roll electronics (if necessary);
- removal of the existing equipment;
- all necessary modification work, if any, on the rolling line for the installation of the components;
- shapemeter roll drive system, if not expressly described.

4. Provisional Project Time Schedule

- Delivery time: spare shapemeter roll 10 month ex works;
- Detail schedule after receipt of order.
- Delivery time: spare parts 4 months ex works;

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5. Performance Data

5.1 Measuring System Accuracy

The errors of the components of all measuring segments of the measuring system result in a double standard deviation two (2) Sigma (95.4 %) accuracy of:

< 1 I-Unit corresponding to 10 µm/m

The proof of the measurement accuracy will be furnished by calculation with the law of error propagation of all single measurement components. The single measurement component errors (linearity and temperature drift) from:

- Sensor,
- Charge amplifier,
- Rotary transmitter,
- Computer system,

will be considered and calculated as percentage total error. To get a relation between the percentage total error and I-Units an typical rolling specific tension [N/mm2] and the modulus of elasticity for the rolling material will be taken into account.

5.2 Accuracy of the Measuring System

On the assumption that the shapemeter roll has been calibrated in accordance with the instructions, the double standard deviation of two (2) Sigma (95.4 %) of the measured values of all single measuring sensors consecutively subjected to the same radial force will be no more than

2 I-Units corresponding to 20 µm/m

The proof of the measuring accuracy will be furnished prior to delivery by applying defined radial forces. During this each measured force will be compared with the applied radial force.

The differences of the values for each sensor will be statistically evaluated as a percentage radial force standard deviation [2 Sigma].
For the calculation of the radial force standard deviation [2 Sigma] in the related fibre length elongation [I-Units] a typical rolling specific tension [N/mm^2] and the modulus of elasticity for the rolling material will be taken into account.

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6. Provisional weight list of equipment

No.	Description	Weight
1.	Spare Shapemeter Roll with bearing housing	2,500 KGs
2.	Spare Parts	120 KGs

7. Sub-Supplier list

Description	Maker
Mechanical Parts:	
Bearings	FAG, SKF
Sealings	Merkel, Freudenberg, Busak&Shamban
Coating (if necessary)	Mitex, LUC, CCC
Electrical Parts:	
Sensors	Kistler, PSI
Charge Amplifier	Kistler
Rotary Transmitter	BFI, Manner

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